

NAVAL WAR COLLEGE
Newport, R.I.

COMMAND AND CONTROL OF OPERATIONAL FIRES:
HOW WILL IT BE DONE?

by

Gary Steven Supnick
Lieutenant Colonel, U.S. Marine Corps

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy

Signature: *Gary Supnick*



18 May 1998

Signature: *Anthony Palermo*
Anthony Palermo
Colonel, U.S. Marine Corps
U.S. Marine Corps Representative

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED			
2. Security Classification Authority:			
3. Declassification/Downgrading Schedule:			
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.			
5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT			
6. Office Symbol: C		7. Address: NAVAL WAR COLLEGE 686 CUSHING ROAD NEWPORT, RI 02841-1207	
8. Title COMMAND AND CONTROL OF OPERATIONAL FIRES: HOW WILL IT BE DONE? (U)			
9. Personal Authors: Gary S. Supnick, Lieutenant Colonel, U.S. Marine Corps			
10. Type of Report: FINAL		11. Date of Report: 18 May 1998	
12. Page Count: 23			
13. Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.			
14. Ten key words that relate to your paper: Operational Fires, Command and Control, Joint Warfare, Joint Force Commander, Information Systems, Technology, Targeting, Battle Damage Assessment, Battlespace, Joint Vision 2010			
15. Abstract: Recent advances in weapon and information systems have enhanced the impact Service components can have on the future battlefield. As a result of this technological explosion the method by which the operational or Joint Force Commander can command and control operational fires has become a dilemma requiring new methods to accomplish this coordination task. New and improved weapon systems now provide the tactical commander and all Service components the ability to contribute to the Joint Force Commander's operational fires. Upcoming information systems will greatly increase the speed of real-time targeting, battle damage assessment and retargeting information. As a consequence of the increased depth of the tactical commander's battlefield and the net-centric manner in which battlefield information is expected to be shared, the command and control of operational fires has become a problem for the Joint Force Commander. Current procedures for the planning of operational fires are antiquated in light of new technology. If the Joint Force Commander is to command and control his operational fires and maintain the tempo of the battlespace certain steps must be taken. These steps include creating a Deep Battle Synchronization Line, a designated operational fires cell at the Joint Task Force level and the approval of joint fires doctrine which currently remains in the draft format.			
16. Distribution / Availability of Abstract:	Unclassified X	Same As Rpt	DTIC Users
17. Abstract Security Classification: UNCLASSIFIED			
18. Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT			
19. Telephone: 841-6461		20. Office Symbol: C	

Abstract of

COMMAND AND CONTROL OF OPERATIONAL FIRES: HOW WILL IT BE DONE?

Recent advances in weapon and information systems have enhanced the impact Service components can have on the future battlefield. As a result of this technological explosion the method by which the operational or Joint Force Commander can command and control operational fires has become a dilemma requiring new methods to accomplish this coordination task.

New and improved weapon systems now provide the tactical commander and all Service components the ability to contribute to the Joint Force Commander's operational fires. Upcoming information systems will greatly increase the speed of real-time targeting, battle damage assessment and retargeting information.

As a consequence of the increased depth of the tactical commander's battlefield and the net-centric manner in which battlefield information is expected to be shared, the command and control of operational fires has become a problem for the Joint Force Commander. Current procedures for the planning of operational fires are antiquated in light of new technology.

If the Joint Force Commander is to command and control his operational fires and maintain the tempo of the battlespace certain steps must be taken. These steps include creating a Deep Battle Synchronization Line, a designated operational fires cell at the Joint Task Force level and the approval of joint fires doctrine which currently remains in the draft format.

TABLE OF CONTENTS

ABSTRACT	ii
I. INTRODUCTION	1
II. WEAPONS TECHNOLOGY	1
III. INFORMATION SYSTEMS	3
IV. THE OPERATIONAL FIRES DILEMMA	5
V. COMMAND AND CONTROL METHODS	10
VI. CONCLUSION	13
VII. RECOMMENDATIONS	14
NOTES	17
BIBLIOGRAPHY	18

Introduction

Recently, the Armed Forces of the United States have experienced a tremendous surge in technology. This technology has led to the conceptual development and actual procurement of new weapons and information systems. These new systems have increased the depth that Service components can influence the battle and are providing new and timely battlefield information to all echelons of command. As a result of this technological explosion and the inadequacy of current doctrine, the method by which the operational or Joint Force Commander can command and control operational fires has become a dilemma requiring new solutions on how this task can be most effectively achieved.

Weapons Technology

Technological developments have increased the range and lethality of weapon systems. Additionally, these new weapon systems are being exploited by the Service components that have developed, trained with and deployed them. The U.S. Army replaced its Lance missile system with the Army Tactical Missile System (ATACMS) as its corps deep fire weapon. The range of the ATACMS is beyond 150 kilometers and is fired from the M270 Multiple Launch Rocket System (MLRS), which is equipped with nine

rocket launchers per system. While there are many fire support improvements with the MLRS, the most important is the increased ability of the commander to mass the effects of fire support. With this combination of reach, lethality and volume, the corps commander has vastly increased his ability to shape the battlefield.¹

Another system that increases the depth and reach of the commander is the AH-64 Apache helicopter. Capable of being armed with 16 Hellfire missiles and of using its laser to illuminate for precision guided missiles, the ability to strike a deep high-value target is readily at the disposal of an Army division or corps commander. This capability enables the commander to shape his battlefield and conduct deep maneuver with his helicopters. As a result, aviation and artillery provide a corps commander not only with the means to influence his deep battle, but also the Joint Force Commander's operational fires as well.²

The U.S. Navy has also acquired the capability for its surface combatants to contribute to operational fires. Many ships are outfitted with the Tomahawk land attack missile and other cruise missiles. Programs are being examined to assess the feasibility of giving ballistic missile submarines the ability to launch cruise missiles. Even Naval Surface Fire Support is expected to gain Enhanced Range Guided Munitions that will increase the range and employment opportunities of naval surface fires.

Still, airpower is one of the most crucial and often used means of striking deep into enemy territory. The U.S. Air Force, U.S. Navy and the U.S. Marine Corps all maintain credible aircraft wings capable of accomplishing the various strike and offensive combat missions. Beyond the capabilities of conventional airframes, our technology is pushing the development of stealth aircraft and a Global Positioning System-aided Targeting System and Global Positioning System-aided munitions.³

With the numerous weapon systems already fielded and those still in the developmental stages, all the Services can now make a valid and decisive contribution to the operational fires of the Joint Force Commander.

Information Systems

Affecting the ability of the Joint Force Commander to target, evaluate the effects of fires, and set his priority of fires, are many current and new information systems. "The term *information system* includes information, information-based processes, information hardware and software systems, and computer-based networks either individually or in combination with each other."⁴ In conjunction with the Chairman of the Joint Chiefs of Staff's *Joint Vision 2010* there are Advanced Concept Technology Demonstrations and operational capabilities being developed to ensure our future information superiority. This

net-centric focus will provide improved agility to the joint warfighter and will greatly exceed the performance and capacity of the present Global Command and Control System.⁵

Examples of the impact new information systems will have on the command and control of operational fires are demonstrated in this review of three on-going Advanced Concept Technology Demonstrations. First, the Joint Continuous-Strike Environment is a software based development that will enhance the existing Service, joint and combined fire support systems. Throughout the Joint Continuous-Strike Environment demonstration its utility will be exercised as deep-strike assets from all Services are employed against time sensitive surface targets that must be attacked inside designated cycle times. Key functions of this system are automated target prioritization, continuous weapon availability monitoring, optimized weapon target pairing, and near-real-time airspace deconfliction.⁶

Another system under development is Precision Targeting Identification. Using a third generation infrared sensor and laser radar system, the capability will be present for a day/night target detection, classification, and dissemination effectiveness which far exceeds present day conventional systems. An important capability of this system will be its ability to monitor targets at considerable stand-off distances and to be readily employed on surveillance platforms.⁷

Theater Precision Strike Operations is a third demonstration. By applying already well-developed technologies, this system will improve considerably on the planning and direction of theater counterfire and precision strike operations. This concept will be obtained through the real-time synchronization of assets in order to permit the commander to focus warfighting assets and influence the battle to accomplish objectives in the manner he desires. Key objectives of this demonstration are to enhance the C⁴I strike planning process and to enhance joint and combined interoperability.⁸

In the area of operational capabilities the most relevant to the command and control of operational fires are those that relate to the command, control, communications, computers, intelligence, surveillance and reconnaissance grid (C⁴ISR). This C⁴ISR Grid is designed to permit the joint warfighter to attack high-priority targets in an expeditious manner throughout his entire area of operations. By employing maximum flexibility and a net-centric approach, commanders at varying levels are able to remain aware of the commander's intent and take the necessary action to execute their portions of the fires plan.⁹

The Operational Fires Dilemma

At the operational level of war, the Joint Force Commander thinks and plans in depth to shape the battlefield to his

advantage and set the conditions that allow him to proceed with the next phase of his plan. Examples of attacks at the operational level are enemy command and control nodes, the operational reserve, lines of communication, logistics, and designated forces or weapon systems such as air defense or long range missiles. To engage these enemy targets, assets of all Services are utilized, outside the tactical depth of the battlefield, in a synchronized manner to achieve the required results.

Operational fires are determined by the target and its relative importance to the campaign or major operation, not by the means by which it was delivered. They may be provided by either air, land or sea-based forces and are designed to have a decided result on a major operation. With the key concept of employment being the appropriate sequencing of the operational fires with the land maneuver or next operational phase of battle.¹⁰

It is in the organization and command and control of the battlespace between the tactical commander's deep battle and that of the operational commander that the operational fires dilemma is joined. With the increased precision, range and lethality of weapon systems available to all Services and improved information systems, the tactical commander now can not only affect his deep battle, but the shaping of the battlefield by the operational commander. This situation is further exacerbated by the

requirement of the Joint Force Commander to task the components of his force to provide his operational fires.

Presently, the land tactical commander considers the end of his close battle and the beginning of his deep battle to be divided by the fire support coordination line. This permissive fire support control measure is normally set by a corps level commander. Before the increase in weapon and information technology, this boundary served as the furthest extent the tactical commander could expect to shape his battle and protect his force. Clearly, new measures for dividing the battlespace between the tactical and operational commander are now necessary.

The next stage in the operational fires dilemma is command and control. Once the Joint Force Commander has provided his subordinate commanders with their weapon system tasks for the shaping of the theater of operations, difficulties exist in deconfliction, battle damage assessment and retasking. With the participation of all Services and more levels of command in the supplying of the assets for operational fires, coordination to ensure the desired synchronization and synergy of effects becomes more formidable. Additionally, with the extended reach of weapons systems available to deconfliction, the tactical commander's response to a threat or need to engage a target within his zone of operations and deep battle, may now also reach into the operational commanders' arena. The problem of deconflicting operational fires is further aggravated by the

cross-boundary contributions that are a result of air, land and sea forces.

Current practices call for the Joint Force Air Component Commander to control operational fires in accordance with the operational idea of the Joint Force Commander. This practice stems from the days when the most prevalent means for striking deep at the enemy was airpower. Planning for these fires occur largely using the "top-down" process, are planned days in advance and are designed to accomplish some set of conditions established by the Joint Force Commander before transitioning to the next phase of his concept of operations. The Joint Force Air Component Commander normally is limited by his ability to receive timely battle damage assessments and a lengthy targeting/retargeting planning cycle. The Joint Force Air Component Commander as the manager of operational fires also competes with his principal duty as the commander of air forces and their operational and tactical employment.

Another method to coordinate the Joint Force Commander's operational fires and commander's intent is the concept of a Joint Force Fires Coordinator. This concept is introduced in draft Joint Publication 3-09, "Doctrine for Joint Fire Support." The use of the Joint Force Fires Coordinator has been incorporated in joint level exercises of all sizes and at least one operation.¹¹ Review of the utility of this concept has met with mixed review from the participating Service components and

their respective doctrine commands. The biggest advantage of the Joint Force Fires Coordinator are improvements in the synchronization of joint fires with other elements such as maneuver, special operations and logistics. Joint Targeting Coordination Board meetings also became more informative and efficient. Disadvantages of this concept were that without clear and carefully defined responsibilities and functions, the Joint Force Fires Coordinator could become an obstacle to effective joint fires by interfering with the roles of the Joint Force Air Component Commander and the Joint Targeting Coordination Board. Other difficulties were experienced in the increased C⁴ support demands and the complicating of the target flow through the addition of another fires cell.¹²

With the fielding of the new information systems will come an elaborate means of receiving battle damage assessment and deciding which and when targets should be reserviced. The few systems, of the many being tested, discussed in this paper will provide information on new targets, battle damage reports on those targets currently being attacked, and data on the status of weapon systems providing the fires. What will compound the issue will be the touted net-centric information systems that will provide the same assessment picture to not only the Joint Force Commander, but his subordinate commanders as well. The temptation will be for the tactical commander providing the fires to decide to reattack a critical target once he receives

assessment on a target which has not been fully destroyed. These types of actions also fuel the deconfliction debate.

The Joint Force Commander will be faced with a highly lethal, long range, precision weapon environment where information on the results of his efforts will be arriving speedily at both his headquarters and those of his subordinates. Being able to assimilate the information, analyze it, make new targeting decisions and have it expeditiously executed is the command and control dilemma facing the operational commander.

Command and Control Methods

The problem of command and control of operational fires was identified in the Joint Universal Lessons Learned System out of experiences in Operation Desert Storm/Shield, Operation Provide Comfort and Exercise Cobra Gold, to name a few.¹³ This problem stems from the need for joint procedures, advanced weapon system technology and with the promulgation of Joint Vision 2010, has garnered even more attention. Proposals to solve the operational fires command and control problem have produced concepts that call for the creation of new battlefield control measures, new organizations or a combination of the two. While there has been considerable progress in resolving this issue, an accepted joint fires publication has been in the draft format for almost nine years. Consequently, the method for command and

control of operational fires has fallen to the combatant commanders to determine since they, or their established Joint Task Force, will be fighting the operational battle.

One attempt to rectify the command and control problem has been the designation of a deep battle synchronization line. This deep battle synchronization line would be an additional battlefield control measure beyond the current doctrinal fire support coordination line. The purpose of this line would be to clearly define and separate the ground commander's deep battle (the space between the fire support coordination line and the deep battle synchronization line) from the operational area of the Joint Force Commander. While this approach provides a clearly defined boundary for the separation and control of fires--it is lacking in substance once hostilities begin. During the early operational and tactical phases of shaping the battlefield, the deep battle synchronization line handily serves its purpose. However, once general hostilities are underway, the responsibility for targeting and engagement of the enemy as he crosses one boundary to the other remains the joint warfighter's predicament.¹³

Another proposal for the operational fires command and control problem is the creation of a Joint Operational Fires Cell at the joint task force staff level. This staff would work with subordinate commands and have the overall responsibility of maintaining an operational focus to joint fires. Planning and

allocation of operational firepower would be centralized at the Joint Force Commander level and would remove this burden from the Joint Force Air Component Commander. Through the Joint Force Commander's planning guidance, the Joint Operational Fires Cell would ensure that Service or functional components receive their appropriate targeting, intelligence collection and battle damage assessment tasks.¹⁴

There must be a number of changes to the current way we do business for the Joint Operational Fires Cell to be successful. Foremost is that the Joint Operational Fires Cell would need to provide the functions at the joint force level that are associated with a fire support coordination center. It would be necessary, if this cell is to function in an efficient and coordinated manner, that it be a permanent staff of all Service components. It also should possess the ability to analyze the results of its operational fires and the consequences that it would have on future plans of the Joint Force Commander and his component commanders.¹⁵

Still another proposal would be to allow the component or functional commander providing the most assets to the Joint Force Commander's operational fires to be the operational fires coordinator. Under this proposition the Joint Force Land Component Commander, Joint Force Maritime Commander or the Service component commander can provide the targeting functions necessary for engaging the operational commander's fires. While

this situation would negate any specific Service from having a parochial edge in all joint task forces, it does not eliminate the requirement for an integrated staff capable of employing all assets to accomplish the Joint Force commander's operational scheme. This staff must be capable of receiving information and rapidly providing fires in the correct targeting priority. A variation of this proposal that would increase its feasibility would be the maintenance of an operational fires augmentation cell at the various combatant commands. These augmentation cells would have the requisite knowledge and equipment to "flesh out" a functional or Service component in the performance of managing joint operational fires.

Conclusion

For the Joint Force Commander to be able to command and control his operational fires as a truly decisive and responsive function he must keep apace of technological, doctrinal and organizational innovations. These various innovations are creating a battlespace with extended reach, lethality and more information than previously experienced, as well as an extremely accelerated tempo of operations. If the Joint Force Commander is not going to abrogate his ability to genuinely command and control his operational fires under the battle circumstances espoused in *Joint Vision 2010*, he must have new battlefield

control measures, a robust operational fires cell, and acceptable doctrine within which to work.

Recommendations

The issue of command and control of operational fires for the Joint Force Commander demands a complete and functional solution devoid of Service parochialism. This solution must fully incorporate the weapons and information systems being developed and provide a concept for operational fires that allows for this technology to be a force multiplier. Most important, any result must be codified in doctrine, not because doctrine will be absolute, but because it will provide a stepping off point for the specifics of each joint operation to depart from. The following are my recommendations:

1. I concur with General Anthony Zinni, Commander-in-Chief, U.S. Central Command who proposes the establishment of another boundary beyond the fire support coordination line to separate the ground and Joint Force Commander's deep and operational battle, respectively.¹⁷ This step goes a considerable distance in solving the problem of tactical commanders and their recently obtained extended battlefield weapon system depth. The battlespace boundaries that were once satisfactory for dividing the ground commander's close and deep battle are simply no longer sufficient.

2. Critical to the employment of the information systems being tested and the concepts of *Joint Vision 2010* is the capability for the Joint Force Commander to truly command and control operational fires. To be able to assimilate target information from all subordinate commands, prioritize assets for operational fires and tactical commanders, receive real time battle damage assessment, reservice targets in a timely fashion and to deconflict the battlespace requires a cell with these responsibilities at the joint staff level. Whatever their title may be, they must be capable of those functions normally associated with a fire support coordination center.

3. This joint operational fires cell must be fully integrated with expertise from all Service components. Besides ensuring the well-rounded knowledge of all weapon systems and fires procedures, a fully integrated staff assists in eliminating Service prejudices.

4. Staffing of the operational fires cell is of considerable significance. Ideally, personnel will be permanently assigned at the combatant CINC level to the billets of the operational fires cell and assigned to a specific joint task force as it is formed. This allows for better training, development of procedures and expertise in an area of increasing technology and operational importance.

5. The promulgation of appropriate doctrine such as Joint Publication 3.09, *Doctrine for Joint Fire Support* must get out of

the coordinating draft stages. While not expected to solve all joint fires problems, it will provide a doctrinal point of departure for the combatant commanders and their allocated forces.

NOTES

¹ Major Leonard G. Tokar, Jr., "U.S. Doctrine for Command and Control of Operational Fires," (Monograph, School of Advanced Military Studies, United States Army Command and General Staff College, Fort Leavenworth, KS: 1996), 13-14.

² Ibid., 13

³ Colonel Albion A. Bergstrom, "Operational Systems Integration," Seminar Lecture, U.S. Naval War College, Newport, RI: 20 April 1998.

⁴ Department of Defense, Joint Warfighting Science and Technology Plan (Washington: 1998), IV-1.

⁵ Ibid., IV-3.

⁶ Ibid., III-10.

⁷ Ibid., III-11.

⁸ Ibid., III-12.

⁹ Ibid., IV-3.

¹⁰ Tokar, 9.

¹¹ A review of numerous Joint Universal Lessons Learned System entries reveal experimentation with the Joint Force Fires Coordinator in exercises Unified Endeavor 95, Agile Provider 94, Tandem Thrust 94 and operations such as Uphold Democracy.

¹² Joint Warfighting Center, Joint Force Fires Coordinator Study (Fort Monroe, VA: 1997), IV-1.

¹³ Ibid., E-7 - E-14.

¹⁴ Major William R. Fenn, "Joint Force Fires Coordination: Towards a Joint Force Answer," (Advanced Research Project, U.S. Naval War College, Newport, RI: 1997), 17.

¹⁵ Tokar, 36.

¹⁶ Tokar, 37-38.

¹⁷ General Anthony Zinni, Commander, U.S. Central Command, MacDill Air Force Base, Tampa, FL. Interview by author, 27 April 1998, Naval Education and Training Center, Newport, RI.

BIBLIOGRAPHY

Articles

- Lukas, Juergen M. "Lesson From Desert Storm." Marine Corps Gazette, May 1998, 78-82.
- Myatt, J. M. "Close Air Support and Fire Support in Desert Shield and Desert Storm." Marine Corps Gazette, May 1998, 70-74.

Government Publications

- U.S. Joint Chiefs of Staff. Department of Defense Dictionary of Dictionary of Military and Associated Terms (Joint Pub 1-02) Washington, D.C.: 23 March 1994.
- U.S. Joint Chiefs of Staff. Doctrine for Command, Control, Communications and Computers (C4) Systems Support to Joint Operations (Joint Pub 6.0) Washington, D.C.: 30 May 1995.
- U.S. Joint Chiefs of Staff. Doctrine for Joint Fire Support (Joint Pub 3-09, Final Coordination Draft) Washington, D.C.: 1997.
- U.S. Joint Chiefs of Staff. Doctrine for Joint Operations (Joint Pub 3.0) Washington, D.C.: 1 February 1995.
- U.S. Joint Chiefs of Staff. Doctrine for Planning Joint Operations (Joint Pub 5.0) Washington, D.C.: 13 April 1995
- U.S. Joint Chiefs of Staff. Joint Task Force Planning Guidance and Procedures (Joint Pub 5-00.2) Washington, D.C.: 13 September 1991
- U.S. Joint Chiefs of Staff. Joint Vision 2010 Washington, D.C.: 1995.
- U.S. Joint Chiefs of Staff. Joint Warfare of the Armed Forces of the United States (Joint Pub 1) Washington, D.C.: 10 January 1995

Interview

- Zinni, Anthony. Commander, U.S. Central Command, MacDill AFB, Tampa, FL. Interview by author, 27 April 1998. Naval Education and Training Center, Newport, RI.

Lecture

Bergstrom, Albion A. "Operational Systems Integration." Lecture.
U.S. Naval War College, Newport, RI: 20 April 1998.

Unpublished Research Projects

Bradley, Michael J. "Operational Fires: Do They Require a Theater FSCoord?" A Monograph, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, KS: 1989.

Fenn, William R. "Joint Force Fires Coordination: Towards a Joint Force Answer." Advanced Research Project, U.S. Naval War College, Newport, RI: 1997.

Garrett, Jerry D. "Strategic Airpower as Operational Fires: Integrating Long-Range Bombers into Campaign Design." A Monograph, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, KS: 1991.

Hammond, Charles O. "Operational Fires and Unity of Command." A Monograph, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, KS: 1990.

Kolditz, Thomas A. "Exploring the Conditions for Decisive Operational Fires." A Monograph, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, KS: 1993.

Madden, Robert W. "A Thousand Points of Light: Integrating Operational Fires into Campaign Design." A Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, Fort Leavenworth, KS: 1991.

Marchant, Richard J. "Operational Maneuver and Fires: A Role for Naval Forces in Land Operations." A Monograph, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, KS: 1989.

Reece, Ralph G. "Operational Fires." Unpublished Research Paper, Air War College, Air University, Maxwell Air Force Base, AL: 1989.

Rice, William J. "Operational Fires -- What's In A Name?" A Monograph, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, KS: 1990.

Tokar, Leonard G. "U.S. Doctrine for Command and Control of Operational Fires." A Monograph, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, KS: 1996.

Other Sources

Joint Warfighting Center. Joint Force Fires Coordinator Study. Virginia: 1997.

U.S. Department of Defense. Joint Warfighting Science and Technology Plan. Washington: 1998.